Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Office of Engineering and Technology Seeks Comment on Technological Advisory Council Spectrum Policy Recommendations	)	ET Docket No. 17-340
	)	
	)	

To: Chief, Office of Engineering and Technology

REPLY COMMENTS OF
THE BOEING COMPANY

The Boeing Company ("Boeing") provides these reply comments in support of certain of the comments that were filed in response to the Commission's Public Notice seeking comment on the spectrum policy recommendations of the FCC's Technological Advisory Council ("TAC").[1] Boeing is responding as the largest manufacturing exporter in the United States. Boeing is a global leader in the design and manufacture of commercial and military aircraft and a leader in the manufacture and launch of commercial and government satellites.

Boeing's reliance on the Commission's spectrum management resources is substantial. Boeing develops and utilizes numerous wireless devices and technologies in the design, manufacture and testing of important communications systems, including avionics, ground, maritime and aerospace systems. Boeing also holds more Office of Engineering and Technology experimental licenses than any other company and operates on behalf of federal agencies under additional NTIA assignments authorizing the use of spectrum to, among other things, test and

[1] Public Notice, *Office of Engineering and Technology Seeks Comment on Technological Advisory Council Policy Recommendations*, ET Docket No. 17-340, DA 17-1165 (Dec. 1, 2017).

certify wireless communications systems installed in the commercial and governmental aircraft and satellites it manufactures at sites throughout the United States.

Boeing uses flight test spectrum to validate the safety and reliability of new and derivative aircraft as required by the Federal Aviation Administration ("FAA"), the Department of Defense, and international and foreign aeronautical regulatory agencies. During the aircraft manufacturing and assembly process, Boeing also installs and tests numerous communication and navigation systems in each aircraft in order to ensure regulatory compliance.

Boeing's operations use hundreds of FCC and federal government authorizations covering more than ten thousand licensed emitters operating in countless frequency segments. Boeing actively manages its FCC authorizations, promptly surrendering those that are no longer needed. Boeing also closely supervises the use of spectrum resources within its company and, as a result, Boeing has no record of any complaints regarding harmful interference resulting from its numerous spectrum-related operations. With this background, Boeing provides the following reply comments on the TAC principles.

I. THE TAC'S SPECTRUM MANAGEMENT PRINCIPLES MUST REFLECT THE NATURE OF THE SPECTRUM USES INVOLVED IN ASSESSING HARMFUL INTERFERENCE

The TAC's first three proposed spectrum management principles address the potential for harmful interference and appear focused primarily on two-way communications services that are normally designed with redundancy, power control, and capabilities for re-transmission in the event of harmful interference. Thus, although harmful interference is undesirable for such services, temporary outages and interruptions can be acceptable and managed as a part of the underlying communications capability.

In contrast, as observed by such commenters as Aviation Spectrum Resources Inc. ("ASRI") and the GPS Innovation Alliance ("GPSIA"), many of the most important uses of radio frequency spectrum are for critical navigation and safety-of-life services that cannot accept the concepts expressed in Principle #3 of "unpredictable" conditions and "occasional service degradation or interruption." As GPSIA observes, the constant availability and reliability of the Global Positioning System is critical to the operation of numerous navigation and control systems used in aircraft, other transportation vehicles, and complex systems. The Commission has always recognized the critical importance of ensuring that GPS is protected from harmful interference and the Commission's spectrum management principles must acknowledge such important exceptions.

The need for higher levels of interference protection, however, is not limited to GPS. Other critical navigation and safety-of-life services must receive heightened protection from interference. For example, radio altimeters operating throughout the 4.2-4.4 GHz band are an essential component of the safe operation of aircraft, supporting precision approach, landing, ground proximity, and collision avoidance systems.[2] The data provided by radio altimeters is used as a height controlling sensor by the Automatic Flight Control System during automated approaches and landings.[3] In many aircraft, the radio altimeter is also directly connected to the Ground Proximity Warning System, which is designed to warn the pilot if the aircraft is flying too low or descending too quickly.[4]

[2] *See* Operational and technical characteristics and protection criteria of radio altimeters utilizing the band 4 200-4 400 MHz, Recommendation ITU-R M.2059-0, at 1, 3 & 5 (2014).

[3] *See id.* at 5.

[4] *See id.*

Interference avoidance is also critical to aircraft flight testing. During flight testing, ground based aeronautical mobile telemetry ("AMT") receivers continuously track and monitor the signals of test aircraft at distances of up to 200 miles. The reception of signals at such distances is necessary to ensure that aircraft can conduct flight test maneuvers at high rates of speed (as required by test protocols), often reaching airspeeds of 600 miles per hour.

During testing, flight test design engineers monitor the airplane's status from a "telemetry" room on the ground, often hundreds of miles from the aircraft. Data regarding the current status of aircraft systems and structures is delivered to the room via the AMT link as rapidly as it is acquired from the instrumentation installed on the airplane. A Test Director in the telemetry room provides test operational instructions and continuous feedback about the airplane's status to the pilot and co-pilot. The safety of the flight crew depends upon the real-time data received from the aircraft using AMT spectrum. Failures in data transmission can result in catastrophic loss of the test aircraft and flight crew. As a result, if transmissions are interrupted – even briefly – the flight test must be terminated and rescheduled, often at considerable expense.

Given this background, the Commission should recognize that a TAC principle that interference must be accepted as a normal occurrence cannot be applied to such critical spectrum uses as aircraft flight testing, GPS, or other safety-of-life services. Instead, the TAC principles must be further refined to adequately acknowledge that the level of interference that can be accepted by a particular service depends on its underlying nature and the importance of its use.

II. THE COMMISSION SHOULD ENSURE THAT ITS SPECTRUM MANAGEMENT PRINCIPLES ARE APPLIED IN A TECHNICALLY NEUTRAL MANNER

The TAC spectrum management principles do appear to be drafted in terms that are intended to be technically neutral. Nevertheless, Boeing joins those commenters in expressing

concern that the principles must be applied in a technically neutral manner recognizing the unique characteristics of each service. For example, Principle #2 instructs that all radio services should plan for "any changes that occur in the future." This seems to suggest that spectrum users should take into account not just the interference environment that exists today, but also the environment that might exist following possible Commission changes in spectrum allocations or service rules for the frequencies in question.

Planning for such unknown conditions would obviously be difficult regardless of the length of the timeframe involved. With respect to satellite services, however, the future involves a particularly long timeframe because satellites necessitate very long term investments that begin with their design, continue with their launch normally 18 to 24 months later, and extend until the end of their mission life, which frequently entails 15 years of service on orbit. Following the start of this process, changes cannot be made to the satellite and therefore the interference environment that the spacecraft must operate within must be reasonably predictable throughout this 15 to 17 year time frame. Given this, it appears unlikely that the concept in Principle #2 of anticipating future conditions can reasonably be applied to the satellite industry.

III. THE COMMISSION MAY NEED TO ADOPT ADDITIONAL MEASURES TO PROTECT THE SENSITIVITY OF PROPRIETARY INFORMATION

Boeing acknowledges the fundamental logic expressed in Recommendation #7 regarding the need for spectrum users to disclose to the FCC the relevant standards, guidelines and operating character mission of their technologies if they expect protection from harmful interference. Boeing anticipates that much – if not all – of this information is already disclosed to the Commission during the equipment certification process. Nevertheless, if additional information disclosure is deemed necessary or appropriate, Boeing concurs with those commenters that have expressed concern regarding whether adequate measures are in place within the Commission's

rules to protect the sensitivity of information that is proprietary to equipment manufacturers and spectrum users. The Commission has long recognized the critical importance to innovation and technological development of ensuring that proprietary and other commercially sensitive information is protected from public disclosure and the Commission should continue to ensure that adequate measures exist to address this issue.

IV. THE COMMISSION SHOULD EXERCISE CAUTION IN ITS IMPLEMENTATION OF RISK-INFORMED INTERFERENCE ASSESSMENT

Boeing joins those commenters that expressed the need for caution in the Commission's consideration and implementation of risk-informed interference assessment. Boeing believes that this type of analysis for assessing potential risks of new spectrum sharing situations does have significant potential benefit, particularly since it purportedly seeks to reach beyond a calculation of pure monetary impact resulting from an interfering situation and also extends to public policy concerns. As the referenced white paper acknowledges, any risk-informed assessment that is developed must "be informed by the FCC's policy on what risks are acceptable, *i.e.* which combinations of likelihood and consequence should be considered harmful or not."[5] Thus, although some forms of cost-benefit analysis attempt to place a monetary value on the loss of a human life, an appropriate public interest determination looks beyond monetary value and also considers the social and ethical requirements of ensuring that the Commission's spectrum management practices promote public safety as an independent, non-monetary public interest mandate.

[5] *See A Quick Introduction to Risk-Informed Interference Assessment*, The Spectrum and Receiver Performance Working Group *of the* Federal Communications Commission's Technological Advisory Council, Version 1.00, at ii (Apr. 1, 2015).

Boeing's major concern with risk-informed interference assessment is that it seems to be focused on the easier half of the equation – *i.e.*, the risk to incumbent services – when the far more difficult assessment for the Commission has long proven to be the likely benefits of proposed new services. To this end, it is helpful to consider the work of the U.S. Nuclear Regulatory Commission in this area, which appears to have formed the basis for the TAC recommendations on this issue. The U.S. Nuclear Regulatory Commission uses risk assessment to determine which regulations to impose on the nuclear industry, *i.e.*, adopting regulations that reduce risk and increase safety to a sufficient extent to justify their costs. In making such assessments, the major input factors in the analysis are reasonably capable of prediction, both in terms of the level of risk of a certain condition and the estimated cost of implementing safety measures to lessen or prevent that risk.

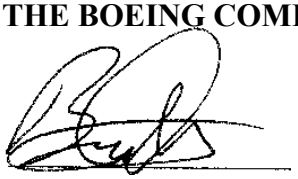
In contrast, in employing risk-informed interference assessment, the Commission must be able to predict with a reasonable level of accuracy both the level of risk to incumbent services and the level of benefit that would be achieved through the introduction of a new service. Historically, the Commission through its notice and comment rulemaking process has had an extremely difficult time predicting the actual benefits of countless proposals for new radio communications services. Proponents of these services have invariably claimed that their introduction will produce tremendous benefits for consumers in the near term. Most such services, however, have experienced very lengthy build out periods, if they are ever built out and brought to market at all.

In raising this point, Boeing acknowledges the statutory mandate that "[i]t shall be the policy of the United States to encourage the provision of new technologies and services to the

public."[6] Boeing does not question the inherent wisdom of this important public interest goal. Nevertheless, in making risk-informed interference assessments, the Commission needs to be certain that it is employing valid and critically-scrutinized data on both sides of the equation. Thus, there is no harm in striving to develop better data regarding the likely risks to incumbent services, but such information will lack any value in the rulemaking process absent equally accurate data regarding the realistic benefits of the new services that are being proposed.

Respectfully submitted,

THE BOEING COMPANY

By: 

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[6] 47 U.S.C. § 157.